

Fuel Guidance - Typical Shipboard Fuel Problems

By Tom Gahs

A shipboard fuel quality problem is typically discovered via high fuel filter differential pressures and a higher than normal rate for fuel filter change outs. There are four primary causes for these filter clogging problems: contaminants from your fuel source; chemical instability; microbiological contamination; and incompatibility between fuel loads. Contaminants from your replenishment source may be too small to see when you do your clear & bright visual test, but still be capable of clogging filters. The later three phenomena tend to develop onboard after the fuel has been delivered, and are the focus of this article. All three problems may cause frequent filter clogging and gelling or “gunk” in the filter housings. It’s difficult to tell which problem you may be dealing with without sending off fuel samples to an analysis lab. Properly identifying the cause is important if corrective actions are going to be effective.

MICROBIOLOGICAL CONTAMINATION. A microbial problem is generally associated with free water in the storage/service tanks. This is especially true in a warm operating environment. Water can be introduced from ballasting, tank vents, intermixed with fuel, and from condensation. The most effective means of preventing microbiological contamination is to keep free water out of the fuel tanks. This requires periodic testing with water finding paste and stripping off any water bottoms. Unfortunately, most CG storage tanks are not (yet) equipped with effective stripping systems. The Navy has found if you can keep the water bottoms stripped off, you shouldn’t need routine use of biocides to keep microbiological contamination in check. Biocides can help, but they aren’t the perfect solution (more on this in a later article).

A clue that the cause may be microbial is if the fuel/residue stinks (but this isn’t always true). Minor microbiological contamination problems can be successfully treated with biocides. However, a severe microbiological contamination problem, might require getting the fuel pumped off and having the tanks cleaned. Adding a biocide once a tank has become badly contaminated will generally cause growth adhering to the tank sides to slough off and drop to the bottom of the tank, or worse, into solution. Filter clogging may therefore worsen after you dose the tanks. Fortunately, a centrifugal purifier will generally be able to remove the microbiological contaminants before the fuel is transferred to the service tanks. Even severely contaminated fuel can possibly be reused if it was dosed with biocide and filtered prior to being returned to clean storage tanks. There are commercial firms that provide this service.

UNSTABLE FUEL. If the fuel is chemically unstable (oxidized), you can experience similar problems. MIL-SPEC fuel will not have stability problems. F-76 must pass an accelerated storage stability test to ensure it will stay stable for at least three years. JP-5, by its very nature, does not form unstable particulates. Most commercial diesel fuel (including Naval Purchase Description MGO) will meet the F-76 storage stability criteria, but there will not be a stability “guarantee.” When fuel becomes unstable, it forms oxygenated particulates that again will rapidly clog fuel filters. It can also leave a black or brown gel-like residue in filter housings and on the bowl of the purifier. It generally does not smell (except as diesel fuel). Centrifugal purifiers may not effectively remove the particulates because their density is so close to that of the fuel. If the fuel is chemically unstable, the source tank needs to be tagged out and the fuel segregated. If proven to be unstable, the only corrective action is to off load the fuel and clean the tank. Do not try and cut the unstable fuel with “good” fuel. It won’t help and will only add to the disposal costs.

INCOMPATIBLE FUEL LOADS. Incompatibility between different loads of distillate fuel is rare, but it can happen. The chances of it happening are higher when additives (such as biocides) are added to the fuel. The Navy has a strict policy of not allowing post-refinery additives in their fuel because of this concern. The CG is transitioning to a similar policy. Many factors can affect incompatibility of fuels, and it's impossible to predict in advance. When it occurs, particulates quickly form as the new fuel mixes with the original fuel and can settle out to the bottom of the storage tanks or stay in solution. The problem will again most likely be identified by rapid fuel filter clogging.

PREVENTATIVE ACTIONS. There are a number of preventative actions you can take:

- Fuel should pass a clear & bright visual acceptance test at delivery. A number of factors can cause a fuel to appear hazy (such as entrained water). However, a fuel that has a microbiological contamination will also typically appear hazy when held up to the light - before the particulates are numerous enough, or large enough, to clog fuel filters. As long as the fuel is clear and bright, it isn’t likely that you’ll have a near term microbial problem. Recent information clarified that a hazy appearance is not a reliable indication of a fuel becoming chemically unstable.

- A dark color is also a good indication of a problem fuel. Note though that domestic commercial fuel products are dyed red. The red color sometimes makes judging the fuel's color difficult. However, even with dye, the fuel should not tend towards darkish brown or black. Overseas, other color dyes may be used (blue or green are common; even black dye can be used in the Med). Dye can therefore make a fuel color test impractical. With only a few exceptions, DESC bunker contract fuel is dyed red, regardless of whether the contract is for a domestic or overseas supplier.
- Continually rotate your fuel stock. Do not routinely take suction from tanks in the same burn order, while never drawing from others. Transfer fuel from the least used tanks to the tanks you generally draw from first before you lift new fuel.
- Burn NPD MGO (and all emergency commercial fuel) as soon as possible. It's not a bad idea to save F-76 or JP-5 as "long term storage" fuel whenever you can get it.
- Periodically check your tanks for free water and strip off water bottoms to the best of your ability.

If you should have a shipboard fuel quality problem, contact your servicing MLC, and Tom Gahs at ELC-026, voice 410-762-6291, fax 410-762-6203, email TGahs@elcbalt.uscg.mil. ELC is developing standard CG procedures for defining and correcting shipboard fuel quality problems. We can also support having your fuel tested to define what immediate actions you should take. The next issue of "Fuel Guidance" will focus on recommended fuel husbandry practices.